

Appl. No. 10/820,855
Amendment dated: February 16, 2007
Reply to OA of: November 16, 2006

REMARKS

This is in response to the Official Action of November 16, 2006 in connection with the above-identified application. Applicants have amended the specification and claims of the instant application, taking into consideration the outstanding Official Action.

With respect to the amendments to the specification, Applicants have again amended paragraph [0023]. Firstly, Applicants have amended paragraph [0023] to disclose that a first electrically conductive layer 306a may comprise a titanium layer, a nickel-vanadium layer and a copper layer. Thus, aluminum is no longer a layer recited in this embodiment of first electrically conductive layer 306a. Applicants have also amended this portion of paragraph [0023] to replace the word "or" with the word "and" in order to convey that all three layers are present in the first electrically conductive layer 306a. This amendment corrects a typographical error in the original specification, and support for this amendment may be seen in, e.g., the recitation in the original specification that the titanium layer of the first electrically conductive layer 306a is directly attached to the a plurality of bond pads 304. This statement indicates that the titanium layer in this example of the first electrically conductive layer is always present (i.e., it is always needed to attach to the bonding pads) and therefore the use of the word "or" is incorrect, as "or" would indicate that the titanium layer does not have to be present in this example of the first electrically conductive layer. Accordingly, Applicants respectfully submit that these amendments to do not introduce new matter into the instant application.

Paragraph [0023] has also been amended to recite that the first electrically conductive layer can alternatively have an aluminum layer, a nickel-vanadium alloy layer and a copper layer, wherein the aluminum layer is directly attached to the bonding pads. This amendment represents a separation of the two embodiments of the first electrically conductive layer disclosed in the original specification. In other words, Applicants have now amended the specification to remove aluminum from the first embodiment of the first electrically conductive layer and separated it into a recitation of

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a second embodiment of the first electrically conductive layer that comprises aluminum, nickel-vanadium alloy and copper layers, rather than trying to list the two separate embodiments together. This amendment to the specification is meant to clarify the original disclosure of two different embodiments of the first electrically conductive layer envisioned by Applicants, and is further in line with the disclosure of two different sets of materials that may be used in the under bump metallization structure 206. Accordingly, Applicants respectfully submit that these amendments to paragraph [0023] do not introduce new matter into the instant application.

With respect to the amendments to the claims, Applicants have amended claim 8 to recite that the first electrically conductive layer comprises a titanium layer, a nickel-vanadium layer alloy layer and a copper layer and the titanium layer is directly attached to the bonding pads. This amendment represents an incorporation of claim 14 into claim 8, minus the recitation of a layer of aluminum. The reason for excluding aluminum is the same as the reason provided above with respect to the amendment to the specification, and therefore Applicants respectfully submit that the specification as originally filed supports this amendment to claim 8. In light of the amendment to claim 8, Applicants have canceled claims 13 and 14.

Applicants have also added new claims 20-24. Claim 20 mirrors amended claim 8 with the exception that claim 20 recites an aluminum layer in place of a titanium layer. The reason for this substitution is the same reason provided above with respect to the amendment to the specification, and therefore Applicants respectfully submit that the specification as originally filed supports new claim 20. Applicants also note that new claims 21-24 mirror original claims 9-11 and 16, respectively, and are therefore clearly supported by the specification as originally filed.

Accordingly, Applicants respectfully submit that all claims now pending in the instant application, including amended claim 8 and new claims 20-24 are in full compliance with the requirements of 35 U.S.C. §112 and are patentable over the references of record.

Turning now the rejections set forth in the outstanding Official Action, the Official

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Action rejects claim 14 as failing to comply with the written description requirement. Claim 14 has been canceled from the instant application, and therefore Applicants respectfully submit that this rejection is moot and request that it be withdrawn.

The rejection of claims 8-10, 13, 14 and 16 under 35 U.S.C. §102(b) as being anticipated by Greer (US Pub. App. No. 2003/0013290) has been carefully considered but is most respectfully traversed in light of the amendments to the claims and the following comments.

Applicants wish to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

The Official Action urges that Greer discloses every element recited in claim 8, including an active surface, a plurality of bonding pads, a passivation, a first electrically conductive layer and a second electrically conductive layer. However, as discussed in detail above, Applicants have amended claim 8 in order to incorporate the subject matter of claim 14. Claim 8 now recites a first electrically conductive layer comprising a titanium layer, a nickel-vanadium layer alloy layer and a copper layer and the titanium layer is directly attached to the bonding pads.

The previous Official Action urges that Greer also discloses the limitation of now-cancelled claim 14, but this assertion is based on an erroneous interpretation of claim 14. The Official Action states that because the specification does not disclose a four-layered structure comprising titanium, aluminum, nickel-vanadium alloy and copper, claim 14 will be interpreted as reciting a first electrically conductive layer comprising

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titanium. However, based on the amendment to claim 8 and the discussion provided above, this interpretation is clearly incorrect. Claim 14 as incorporated into claim 8 recites a first electrically conductive layer comprising three layers - titanium, nickel-vanadium alloy and copper. Greer clearly fails to disclose a first electrically conductive layer comprising a titanium layer, a nickel-vanadium alloy layer and a copper layer as recited in amended claim 8 and therefore does not anticipate claim 8.

Accordingly, because Greer fails to disclose every element of claim 8, Applicants respectfully submit that a proper §102 rejection according to the guidelines set forth in MPEP §2131 has not been established and therefore the anticipation rejection of claim 8 over Greer should be withdrawn.

Additionally, Applicants note that because Greer fails to disclose every element of independent claim 8, the anticipation rejection over Greer of all claims depending therefrom should also be withdrawn. Accordingly, Applicants respectfully request that the §102(b) rejection of claims 9, 10 and 16 be withdrawn.

The rejection of claims 11, 12, 15 and 18 under 35 U.S.C. §103(a) as being obvious over Greer as applied to claim 8 in view of Kuwabara et al. (US Pat. No. 6,707,153) and the rejection of claim 17 under 35 U.S.C. §103(a) as being obvious over Greer as applied to claim 11 have each been carefully considered but are most respectfully traversed in light of the following comments.

Applicants wish to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure.

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In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Applicants also note MPEP §2143.01, which states in part that, if a proposed modification would render the prior art invention unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Applicants also most respectfully direct the Examiner's attention to MPEP § 2144.08 (page 2100-114) wherein it is stated that Office personnel should consider all rebuttal argument and evidence presented by applicant and the citation of In re Soni for error in not considering evidence presented in the specification.

The rejection of claims 11, 12, 15, 17 and 18 each rely on the faulty assertion that Greer discloses each and every element of claim 8. Furthermore, Applicants respectfully submit that the Kuwabara reference fails to remedy the deficiencies identified above with respect to the rejection of claim 8 over Greer alone. That is to say, Kuwabara fails to disclose the first electrically conductive layer comprising a titanium layer, a nickel-vanadium alloy layer and a copper layer that Greer fails to disclose. Accordingly, since neither Greer nor Kuwabara, either standing alone or when taken in combination, disclose or suggest every element of claim 8, Applicants respectfully submit that all claims depending therefrom are also patentable over the references of record. Because the Official Action has failed to establish a proper §103 rejection of claims 11, 12, 15, 17 and 18 according to the guidelines set forth in MPEP §2143, Applicants respectfully request that the rejections of these claims be withdrawn.

The rejection of claims 1-4, 6 and 7 under 35 U.S.C. §103(a) as being unpatentable over Applicant's Admitted Prior Art (AAPA) in view of Andricacos et al.

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(US Pat. No. 6,224,690) has been carefully considered but is most respectfully traversed in light of the following comments.

The Official Action urges that AAPA discloses an under bump metallization as recited in claim 1 including a under bump metallization layer comprising an adhesive layer, a first barrier layer, and a wetting layer, but expressly acknowledges that AAPA fails to disclose a second barrier layer disposed on the wetting layer wherein the material of the second barrier layer comprises tin and nickel. The Official Action cites Andricacos as disclosing a second barrier layer of nickel-tin intermetallic disposed on the wetting layer and urges that it would have been obvious to combine the nickel-tin intermetallic on the wetting layer for the purpose of preventing the reaction of the solder with the underlying copper. Applicants specifically traverse this combination.

Firstly, Applicants note that, contrary to the position taken in the Official Action, Andricacos does not disclose disposing a nickel-tin intermetallic on the wetting layer. Rather, as clearly stated at, e.g., col. 5, line 27, a nickel-only film is formed on the TiW/CrCu/Cu sandwich. Thus, Andricacos does not disclose a second barrier layer comprising tin and nickel, but rather discloses a second barrier layer of nickel only. Accordingly, because neither AAPA nor Andircacos disclose or suggest every element of the claimed invention, Applicants respectfully request that this rejection be withdrawn.

What the Official Action appears to cite in the Andircacos reference is the formation of a nickel-tin layer after the nickel has served as a barrier layer. The nickel layer reacts with the solder material comprising tin, and in serving its function as a barrier layer, a nickel-tin layer is formed. However, Andricacos does not disclose that the nickel-tin layer formed after the soldering is a barrier layer. Rather, the Andricacos reference discloses a barrier layer made of tin and further describes what would happen to the nickel-only barrier layer upon reaction with the solder comprising tin.

Because Andricacos does not disclose a barrier layer made of nickel-tin, the assertion in the Official Action that it would be obvious to combine a nickel-tin layer as disclosed in Andricacos on a wetting layer as in AAPA in order to prevent reaction of the solder with the underlying copper is incorrect. Andricacos discloses that using a

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barrier layer of nickel only would prevent reaction between the solder and the underlying copper layer, and that prevention of this reaction is due in part to the reaction between tin in the solder and the nickel-only layer. But there is no teaching in Andricacos that the nickel-tin layer formed as a result of the reaction between the solder and tin-only layer could also be used to prevent reaction between the solder and the underlying copper layer.

Applicants stress that this is not an argument that the nickel-tin layer formed from the reaction of the nickel-only layer and solder material does not function as a barrier layer. Rather, this is an argument that the motivation statement provided in the Official Action is not correct and therefore a proper §103 rejection has not been established. One of ordinary skill in the art would not be motivated to place the resultant nickel-tin layer of Andricacos on a wetting layer for the purpose of preventing the reaction of the solder with the underlying copper because Andricacos provides no such teaching. The teaching in Andricacos is limited to using a nickel-only layer for this purpose.

Accordingly, because the Official Action has failed to provide a proper motivation statement required to establish a §103 rejection as set forth in MPEP §2143, Applicants respectfully request that the rejection of claim 1 as being unpatentable over AAPA in view of Andricacos be withdrawn.

Furthermore, because claims 2-4, 6 and 7 each depend from claim 1, Applicants respectfully submit that these claims are patentable over AAPA and Andricacos for the same reasons as set forth above with respect to the §103 rejection of claim 1 over AAPA and Andricacos. Accordingly, Applicants respectfully request that the §103 rejection of claims 2-4, 6 and 7 also be withdrawn.

Finally, Applicants also specifically traverse the statements made with respect to the rejection of claim 2 over AAPA in view of Andricacos. The Official Action urges that Andricacos teaches that the quantity of tin in the tin-nickel layer formed after the reaction between the nickel-only layer and the solder material is smaller than the quantity of nickel. No specific portion of Andricacos is cited as expressly disclosing this element of the claim. Rather, the Official Action urges that this is inherent because

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after the tin-nickel intermetallic is formed, the UBM does not spall off. Applicants challenge the Official Action on this statement and respectfully request further evidence in support of the assertion of inherency. Applicants can see no reason why the quantity of tin must be smaller than the quantity of nickel in the tin-nickel layer formed after soldering simply because the UBM does not spall off. Absent support for this allegation, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and therefore the burden has not been shifted to Applicants to show why the claims are not obvious over the prior art references.

In view of the above comments and further amendments to the claims, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,
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